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ABSTRACT

This study investigated changes in intellectual orientations of 4,124 California high school students who completed the Omnibus Personality Inventory. The three dependent measures of intellectual orientations were Autonomy (which measures independence of thought and judgment), Theoretical Orientation (which reflects an interest in science, problem-solving and logical thinking), and Thinking Introversion (which measures preference for reflective, abstract thinking and academic activities). The statistical model that was fit to the data was a repeated measures model, an analysis-of-variance mixed model with two grouping factors (sex and type of program of the student), and within-subject factor (intellectual orientation measures at grades 9 and 10) as the fixed effects factor. The results of the study showed that students in diverse high school programs (General, College Preparatory and Vocational) in California became more interested in ideas and reflective thought (Thinking Introversion), liberally oriented, more analytical and critical in their approach to problems. The data showed differential change in intellectual orientations for the students in different high school programs, however. (Author/BW)

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Multivariate Analysis of Repeated Measurements of Students' Intellectual orientations

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Abstract

This study investigated changes in Intellectual orientations of high school students in the State of California. The three dependent measures of intellectual orientations were Antonomy (which measures independence of thought and judgment), Theoretical Orientation (which reflects an interest in science, problem-solving and logical thinking), and Thinking Introversion (which measures preference for reflective, abstract thinking and academic activities).

The statistical model that was fit to the data was a repeated measures model, an analysis-of-variance mixed model with two grouping factors (sex and type of program of the student), and within-subject factor (Intellectual orientation measures at grades 9 and 10) as the fixed effects factors.

The results of the study showed that students in diverse high school programs (general, College Preparatory and Vocational) in California became more interested in ideas and reflective thought (Thinking Introversion), liberally oriented, more analytical and critical in their approach to problems. The data showed differental change in intellectual orientations for the students in different high school programs however.

Multivariate Analysis of Repeated Measurements of Students' Intellectual Orientations

The long standing interest in predicting educational outcomes from measures of school abilities, achievements and other student background characteristics has led to a preponderance of studies of potential factors that influence students' achievement in public schools (Coleman, et al. 1966, Mosteller and Moynihan 1972, Summers and Wolfe, 1974). While descriptive information on academic achievement, college plans, aspirations and interests of high school students is readily available, little research has been done on intellectual disposition of high school students (Trent and Medsker, 1968). The purpose of this study is to seek an answer to the question: Do students in diverse high school programs in California become more interested in ideas and reflective thought; less judgmental, more tolerant and flexible in attitudes; more analytical and critical in their approach to problem? The focus of the investigation was on intellectual orientations or an aspect of personality characteristics of students which may be relatively pervasive and deep-seated than conventional school outcomes such as academic performance, career goals, aspirations and attitudes.

Specifically, the object of this study was to examine changes in intellectual orientations of male and female students in the state of California who enrolled in different programs (general, college preparatory or vocational) in high school. The statistical model that was fit to the data was repeated measures model, an analysis-of-variance mixed model with two grouping factors (program and sex), and within-subjects factor (orientation measures at grades 9 and 10) as the fixed-effects factors. The subjects were nested in the grouping factors and crossed within subjects factors.

Data Source

The data for this study were collected as part of the SCOPE (School to College: Opportunities for Postsecondary Education) five-year longitudinal study of high school students. The SCOPE Project began in 1965 under the joint

sponsorship of the College Entrance Examination Board and the Center for Research and Development in Higher Education at the University of California at Berkeley.

A major objective of the project was to investigate the relationship between a larger number of attributes and behaviors and the educational aspirations of more than 45,000 high school students from California, Illinois, Massachusetts and North Carolina. It was an attempt "to understand the concommitants of students' educational goal projections and ways in which students may therefore be better served in their high school experience" (Tillery and Kildegaard, 1973).

The present study was focused on a sample of 4,124 California high school students who completed intellectual orientation scales of the Omnibus Personality Inventory--OPI (Heist and Yonge, 1968) as freshmen and again as seniors. Specifically, the data set for this study consisted of the following three dependent measures of intellectual orientations:

Autonomy, (Au), which measures independence of thought and judgment, and general non-authoritarian thinking.

Theoretical Orientation (TO), which reflects an interest in science, problem-solving, and logical thinking.

Thinking Introversion (TI), which measures preference for reflective, abstract thinking and academic activities.

Each orientation was measured twice at grades 9 and 12. In addition, the subjects were divided into three groups based on their high school program (general, college preparatory or vocational) and sex.

Results

The mean scores for Autonomy, Theoretical Orientation and Thinking Introversion scales for the grouping factors (program and sex) have been presented in Tables 1A and 1B.

TABLE 1A

Mean Scores, Ns and Standard Deviation for Autonomy, Theoretical Orientation and Thinking Introversion Scales by Type of High School Program

Program	N	Mean (Standard Deviation)		
		AU	TO	TI
General	890	4.37 (2.57)	6.44 (2.99)	4.23 (1.58)
College Prep	2,326	5.28 (2.84)	7.13 (3.45)	4.21 (1.34)
Vocational	908	4.28 (2.44)	6.06 (2.84)	4.28 (1.51)

TABLE 1B

Mean Scores, Ns and Standard Deviation for Autonomy, Theoretical Orientation and Thinking Introversion Scales by Sex

Sex	N	Mean (Standard Deviation)		
		AU	TO	TI
Male	1891	4.78 (2.68)	6.83 (3.19)	4.30 (1.48)
Female	2233	4.93 (2.79)	6.67 (3.31)	4.17 (1.39)

The data were subjected to fixed effects multivariate analysis of repeated measures using BMDP 4V (Dixon, 1981). The overall MANOVA test showed a statistically significant association between the grouping factors and intellectual orientations at .01 level. The results of univariate tests which considered Au, TO, and TI separately were all significant at .01 level. The MANOVA test of program x sex interaction was not significant at the .01 level. The results of univariate tests also substantiated the lack of significant interaction between program and sex. The results of MANOVA tests of program and sex main effects have been presented in Table 2. As shown in the table, both MANOVA

and univariate tests, show that sex has significant effect on changes in intellectual orientations of students. The type of high school program students pursued also has a significant relationship with changes in Autonomy and Theoretical orientations. The relationship between program and thinking introversion as indicated by the univariate was not significant however.

TABLE 2

Results of Repeated Measures Analysis of
Intellectual Orientations Data:

Effect	Variate	Statistic	F	DF	P
Program					
	All*	LRATIO = .918	60.1	6,8232	0.01
	Autonomy	SS = 1808.32 MS = 904.16	144.77	2,4118	0.01
	Theoretical Orient.	SS = 1549.81 MS = 774.91	109.83	2,4118	0.01
	Thinking Introv.	SS = 7.94 MS = 3.97	2.15	2,4118	0.12
Sex					
	All	TSQ = 30.75	10.3	3,4116	0.01
	Autonomy	SS = 43.04 MS = 43.04	6.89	1,4118	0.01
	Theoretical Orient.	SS = 39.87 MS = 39.81	5.65	1.4118	0.01
	Thinking Introv.	SS = 18.92 MS = 18.92	10.22	1,4118	0.01

*This subsection contains the multivariate analysis. LRATIO is Wilk's lambda likelihood ratio for multivariate test. TSQ is Hotelling's T - squared

After rejecting the overall hypothesis of no difference in mean centroids of the groups, the next step in the analysis was to investigate group differences on Autonomy, Theoretical orientation and Thinking Introversion. Bonferroni t statistic was used to perform pair wise comparisons among the group means to isolate the specific sources of group differences on each measure of intellectual orientation. The results of the comparisons are presented in Tables 3 and 4. As shown in Table 3, there was significant difference between females who were in college preparatory programs and their counterparts who were in general or vocational programs on Theoretical orientation and Autonomy scales. Females in college preparatory programs showed greater change on the two measures than those who were in the other programs. However, the differences among the female students on Thinking introversion seemed to be contributed largely by the vocational and general students.

It is seen from Table 4, that the sources of group differences among the females on each of the intellectual orientation measures are the same as those for the males. Notice that on both Theoretical orientation and Autonomy scales, male students who were in college preparatory programs showed greater change than those who were in general or vocational programs. However, on Thinking introversion the situation was reversed. That is, the general or vocational program students showed greater change than the college preparatory students.

TABLE 3

Mean Differences on TO, TI and AU Among the Female Group as Indicated by Bonferroni t Statistic

		$\bar{X}$Col	$\bar{X}$Gen	$\bar{X}$Voc**
Theoretical Orientation	$\bar{X}$Col	-	2.5*	3.3*
	$\bar{X}$Gen		-	0.8*
	$\bar{X}$Voc			
		$\bar{X}$Col	$\bar{X}$Gen	$\bar{X}$Voc
Autonomy	$\bar{X}$Col	-	1.1*	1.4*
	$\bar{X}$Gen		-	0.3 (NS)
	$\bar{X}$Voc			
		$\bar{X}$Gen	$\bar{X}$Voc	$\bar{X}$Col
Thinking Introversion	$\bar{X}$Gen	-	0.1 (NS)	0.9*
	$\bar{X}$Voc		-	1.0*
	$\bar{X}$Col			

*Significant at .01

**Col = College Program
Gen = General Program
Voc = Vocational Program

TABLE 4

Mean Differences on TO, TI and AU Among the Male Group as Indicated by Bonferroni t Statistic

		$\bar{X}$Col	$\bar{X}$Gen	$\bar{X}$Voc
Theoretical Orientation	$\bar{X}$Col	-	2.2*	2.8*
	$\bar{X}$Gen		-	0.6 (NS)
	$\bar{X}$Voc			
		$\bar{X}$Col	$\bar{X}$Gen	$\bar{X}$Voc
Autonomy	$\bar{X}$Col	-	0.6*	0.8*
	$\bar{X}$Gen		-	0.2(NS)
	$\bar{X}$Voc			
		$\bar{X}$Gen	$\bar{X}$Voc	$\bar{X}$Col
Thinking Introversion	$\bar{X}$Gen	-	0.2 (NS)	0.9*
	$\bar{X}$Voc		-	0.7*
	XCol			

*Significant at .01

A major objective of the data analysis was to obtain a parsimonious description, or a clearer understanding of the nature of group differences on intellectual orientation measures. This objective necessitated that the data be subjected to discriminant analysis to reveal major group differences through the connonical variates. Two functions were derived from the analysis. They provided dimensions in which the groups were well separated. The data presented in Table 5 show the within structure coefficients, the correlations of each dependent variable (Au, TO, TI) with each of the discriminant functions. The data indicate that Autonomy and Theoretical orientation correlate highly with Function 1. On Function 2, Thinking Introversion has the highest correlation followed by the Theoretical orientation. Autonomy correlates very little with Function 2. The results of the discriminant analysis showed that Autonomy and Theoretical orientation were primarily responsible for the group separation that has been achieved along the first underlying dimension (Function 1). Thinking Introversion is closely related to Function 2. It is the dominant variable on the function.

TABLE 5

Within Structure Coefficients of Iltellectual Orientations
Data of California High School Students

Variable	Function 1	Function 2
Autonomy	.801	-.227
Theoretical Orientation	.780	.504
Thinking Introversion	-.083	.854

Summary

The data presented above indicate that students in diverse high school programs (general, college preparatory, and vocational) in California showed general changes in intellectual orientation. They showed positive changes on To, Au, and Ti. The students became more interested in ideas and reflective though, liberally oriented, more analytical and critical in their approach to problems. There was also evidence for differential change for the students in the different high school programs. The data indicated greater development (change) of intellectual interests (To) and autonomy for students in college preparatory program than those in general or vocational programs. However, general or vocational program students showed the greater change on Thinking Introversion scale over the four years of high school education.